Factors affecting egg production and layer bird mortality in private poultry farms in the sub-humid zone of Nigeria

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Abstract

Egg production and layer bird mortality data obtained from 5 different private farms in Zaria within the sub-humid zone of Nigeria, over a six-year period (1994 - 1999) were subjected to least squares analysis to determine the effects of age, season and year. It was demonstrated that age had a highly significant influence ($P<0.01$) on egg production in that birds falling within the age group 30 - 39 weeks produced the highest number of eggs (3255 ± 109), while birds over 100 weeks of age produced the least number of eggs (1206 ± 412). Similarly, seasonal variation in egg production was also significant ($P<0.05$); the highest egg production (2926 ± 90) was obtained during the early dry season, and the lowest (2423 ± 95) during the late wet season. Mortality was generally low (0.0 - 0.9%) and not significantly different from 20 - 49 weeks of age ($P>0.05$). However, from 50 to 100 weeks of age, highly significant differences ($P<0.01$) in mortality were observed with 90 - 100 weeks age group recording the highest mortality of 15.7 ± 1.3 %. Furthermore, yearly variations in egg production and mortality were highly significant ($P<0.01$) with 1999 producing the most eggs (4410 ± 102) and recording the least mortality (1.4%). It was concluded that due to the significant seasonal, age and yearly variations, data on egg production and mortality need to be adjusted for these effects for unbiased comparison between and within farms. Furthermore, farmers can make adequate feeding preparations commensurate with each season for optimal egg production.

Key words: Age, egg production, mortality, season, sub-humid zone

Introduction

Two major indices of measuring the profitability of raising layer birds in a poultry enterprise is total number of good quality eggs produced and mortality. In a comparative analysis of egg production and mortality between farms, it is important to adjust for all possible sources of variation in order to ensure that such a comparison is unbiased. Kekeocha (1978) and Dafwang (1987) reported that age and disease among others, are factors that affect the productivity of laying hens. Conclusions drawn from data emanating from Government and Research Institute Farms may not necessarily reflect the true situation of production in Private Farms because the management, personnel and infrastructural facilities are not the same. Therefore, the objective of this study was to investigate the effects of age, season and year on egg production and mortality in five private farms in Zaria located within the sub-humid zone of Nigeria.

Materials and methods

Description of the study area and data collection: The data used for this analysis consisted of six thousand six-hundred and seventy-two records on egg production and mortality in 5 private farms (Farms 1, 2, 3, 4, and 5) in Zaria, Nigeria. Farms 1, 2 and 4 were back-yard poultry enterprises with an approximate flock size of roughly 500 – 800 layers, while farms 3 and 5 were commercial poultry farms with approximate flock sizes of 2000 and 3000 layers respectively. All the farms kept birds of the Shika Brown breed. This breed of hens was developed at the National Animal Production

Research Institute (NAPRI) Shika, Nigeria, and is known for its persistency of egg production, hardiness and total number of eggs produced. The study area is located in the Northern Guinea Savannah with an average annual rainfall of about 1100mm, monthly distributed between May and October and a monthly mean temperature of 14 - 30 ^{o}C and 21 - 30^{o}C during the wet and hot dry seasons respectively.

Management of the birds: The birds in Farms 3 and 5 were raised under intensive management system. They were housed in three-tier wire battery cages, fitted with feeders and waterers and located in tropical type-open-sided poultry buildings. Feeds were served once a day at 7 am and fresh clean water provided ad libitum. Eggs were picked twice a day in the mornings and in evenings. Laying hens were observed daily and egg production and mortality records were adequately kept. Farms 1, 2 and 4 were raised under deep litter system. Feeds were served every morning and clean fresh water provided ad libitum. Egg production and mortality records were taken on a daily basis as in Farms 3 and 5. In all the farms, strict health management routines of vaccination, deworming and delousing were observed

Data editing and statistical analysis: Variables analysed included farm, age of birds, season and year. The years were from 1994 to 1999 while season was classified into early dry (November - January), late dry (February - April) early wet (May-July) and late wet (August - October). General linear models procedure (PROC GLM) of SAS (1986) was utilized in running least squares analysis of variance to test for fixed effects and their interactions on total number of eggs produced and percentage mortality. The analytical model used was:

$Y_{ijkl} = \mu + F_i + A_j + S_k + YR_l + (FS)_{ik} + (FYR)_{il} + (AS)_{jk} + (AYR)_{jl} + (SYR)_{kl} + e_{ijklm}$

where Y_{ijklm} = observation on the i^{th} farm of the j^{th} age-group within the k^{th} season l^{th} year of production

μ = Overall mean

F_i = fixed effect of the i^{th} farm

A_j = fixed effect of the j^{th} age-group

S_k = fixed effect of the k^{th} season

YR_l = fixed effect of the l^{th} year

$(FS)_{ik} + (FYR)_{il} + (AS)_{jk} + (AYR)_{jl} + (SYR)_{kl}$ = interactions

e_{ijklm} = random error

Since all interactions were not significant, these were dropped from the model. Furthermore, means based on Farms were not tabulated in this study since the private farms didn 't want their individual productivity reflected to guard against possible administrative backlash in a situation where laxity seemed to be implied by the results. However, there were significant differences between farms.

Results and discussion

Effect of season: Seasonal fluctuations in the subhumid zone of Nigeria are very crucial to overall egg production by layer birds, mortality, sales and feed costs. It is typical for temperatures and relative humidity in this zone during the late dry season of February to April to hit 36°C and 21% respectively. At this period, egg production is at its lowest because the birds drastically reduce their feed intakes. On the market scene, egg sales also drop as few consumers buy due to storage problems during the hot season. In contrast, during the late wet season of August to October when temperature and relative humidity average 25°C and 72% respectively, the feed intake of the birds increases and egg production also goes up. Therefore, season had a highly significant effect ($P < 0.01$) on egg production and mortality (Table 1). The number of eggs produced was highest in early dry season (2936 $\pm$ 90) and lowest during the late wet season (2423 $\pm$ 95). Generally, the hot season doesn't favor egg production because of the heat stress experienced during this period (Abdu et al, 1982). Feed intake decreases with increase in temperature (Payne 1966a). Dafwang (1987) opined that pullets should be reared in such a way that they do not come into peak production during the hottest months of the year. The temperature of Zaria where this work was carried out ranges from 21 - 36°C during the hot season. The thermoneutral zone of laying birds for optimal production has been reported to be 12.6 - 20.0°C. The temperature obtained in early wet season and late wet season is far higher than 26°C which may account for the reduction in eggs produced during this period. Ogbogu (1988) noted that the comfort zone for layers is between 13 and 21°C and that at 30 - 40°C, the egg size and number produced dropped drastically due to reduced feed intake. The shell and internal quality of eggs were also poor since the protein, minerals (calcium) and vitamins consumed were not enough to meet the demands of normal egg production. Season had a significant effect ($P<0.05$) on mortality rate and the late dry season recorded the highest mortality of 6.0%. However, there were no seasonal variations ($P>0.05$) in mortality during the early dry, early wet and late wet seasons. Payne (1966a) observed a low egg production and mortality in leghorn pullets when raised at a constant temperature of 32 ^{o}C when compared with those raised on temperature range of 13 - 32^{o}C. Furthermore, Payne (1966b) demonstrated that at 37^{o}C or higher for about 8 hrs, hens started to die of heat prostration while egg size and shell thinning were common.

Effect of year: Year had significant effect ($P<0.05$) on egg production (Table 2). The number of eggs produced increased from 1994 to 1999 with 1999 recording the highest number of eggs produced (4410$\pm$ 102). However, the number of eggs produced dropped in 1996 (1529 $\pm$ 107) before rising again between 1997 and 1999. In various years, the climatic and weather situations change and this exerts an influence on rainfall, temperature, relative humidity and disease outbreaks. This is the major reason why there were significant differences in number of eggs produced in different years.

Effect of age: Table 3 shows that age had a significant effect ($P<0.05$) on egg production. The peak production was between 30 - 39 weeks of age. There was no significant difference in egg produced between 30 - 39 weeks and 40 - 49 weeks ($P>0.05$) (3255 $\pm$ 109 and 3104 $\pm$ 110 respectively). Thereafter, there was a decrease in the number of eggs produced till the end of the laying period, from 50 - 59 weeks, 60 - 69 weeks, 70 - 79 weeks, 80 - 89 weeks, 90 - 100wks and 100 and above (2878± 110.83, 2664± 113, 2420 ± 112, 2119 ± 130, 2059± 182 and 1206± 413 respectively). This observation is in agreement with Oluyemi and Robert (1979), who described the laying pattern of the laying hen as in 4 phases; gradual rise, peak, plateau and gradual decline to the point that it would not be economically justifiable to retain the hen in the flock. A major difference in this work however, is that the decline in egg production was determined more by festive seasons like Christmas and Sallah when poultry farmers dispose of their flocks because of the high demand of chickens for which consumers are willing to pay sometimes as high as four times the normal price of a spent layer bird. Therefore, from the result in Table 3, the highest mortality was recorded at 90 - 100 weeks of age (15.7 ± 3.1) which was statistically the same with the mortality recorded in 100 weeks and above (13.94 ± 7.0). This high mortality rate at this stage may be due to a large number of culled birds as a result of the low number of eggs produced. This is also in agreement with Oluyemi and Robert (1979) who reported that as from 62nd week of age, the number of eggs produced begins to drop gradually to practically nil.

Conclusion

It can be concluded that season, age and year had significant effects on egg production and mortality, hence the need to adjust for these factors in making comparisons between and within farms. For maximum egg production, the best time to start rearing pullets in the study area is the month of January or February, so that their peak production will fall between the months of June and August. For profit maximization, laying hens should not be kept in the flock beyond the 62nd week of age before disposing them as spent layers.

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Table 1. Seasonal variation in egg production and mortality

Season	Total number of days	No. of observations	Number of birds	Number of eggs produced	Mortality (%)
Early dry (Nov - Jan)	90	1162	722 ± 10^{a}	2936 ± 90^{a}	2.4 ± 1.4^{b}
Late dry (Feb - April)	90	2155	710 ± 10^{a}	2600 ± 107^{b}	6.0 ± 1.72^{a}
Early wet (May - July)	90	1152	709 ± 12^{b}	2567 ± 105^{b}	1.9 ± 1.68^{b}
Late wet (Aug - Oct)	90	2203	711 ± 11^{b}	2423 ± 95^{b}	1.2 ± 1.55^{b}

Column means bearing different superscripts are significantly different ($P<0.01$) .

Table 2. Yearly variation in egg production and mortality (LSM $\pm$ s.e.)

Year	Total number of days	No of observations	No. of birds	No. of eggs produced	Mortality (%)
1994	365	1102	607 ± 7	2037 ± 186^{c}	10 ± 2.9^{c}
1995	365	1105	628 ± 7	2102 ± 106^{c}	4.8 ± 1.7^{c}
1996	366	1107	488 ± 4	1529 ± 107^{d}	6.3 ± 1.7^{b}
1997	365	1115	530 ± 5	2251 ± 109^{c}	2.5 ± 1.7^{d}
1998	365	1103	848 ± 14	3127 ± 90^{b}	4.7 ± 1.4^{c}
1999	365	1140	909 ± 15	4410 ± 102^{a}	1.4 ± 1.6^{b}

Column means bearing different superscripts are significantly different ($P<0.01$) .

Table 3. Age-group variation in egg production and mortality (LSM ± s.e.)

Age group (weeks)	Total number of days	Number of birds	Number of eggs produced	Mortality (%)
20 – 29	70	768 ± 13	2436 ± 112[c]	0.0 ± 0.1[d]
30 – 39	70	734 ± 12	3255 ± 109[a]	0.2 ± 1.8[d]
40-49	70	729 ± 12	3104 ± 110[a]	0.9 ± 1.8[d]
50-59	70	711 ± 11	2878 ± 110[b]	2.7 ± 1.9[c]
60-69	70	690 ± 9	2664 ± 113[b]	1.9 ± 1.9[c]
70-79	70	676 ± 9	2420 ± 130[c]	2.6 ± 2.0[c]
80-89	70	685 ± 8	2119 ± 130[d]	6.7 ± 2.2[b]
90-100	70	690 ± 9	2059 ± 182[d]	15.7 ± 3.1[a]
>100	>70	659 ± 7	1206 ± 412[e]	13.9 ± 7.0[a]

Column means bearing different superscripts are significantly different (P<0.01) .